(12) PATENT APPLICATION
(19) AUSTRALIAN PATENT OFFICE

(11) Application No. **AU 199051441 A1**
(10) Patent No. **631615**

(54) Title
Improved hand-held power tool

(51) International Patent Classification(s)
B23B 045/02 **B23B 045/00**

(21) Application No: **199051441** (22) Date of Filing: **1990.03.16**

(30) Priority Data

(31) Number	(32) Date	(33) Country
PJ3371	**1989.03.28**	**AU**

(43) Publication Journal Date: **1990.10.04**
(44) Accepted Journal Date: **1992.12.03**

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John Whitehead

(54) Inventor(s)
John Whitehead

631615

COMMONWEALTH OF AUSTRALIA

Patents Act 1952

Form 1
Regulation 9

APPLICATION FOR A STANDARD PATENT

I, John Whitehead

of Colombo Creek, Jerilderie, New South Wales 2716.

hereby apply for the grant of a standard patent for an invention entitled: Improved Electric Drill

Which is described in the accompanying provisional specification.

My address for service is:

H.J.Rantzen & Co.
Patent and Trade Mark Attorneys,
85 John Street,
Woollahra,
New South Wales 2025.

Dated this 28th. day of March 1989

N.J. Rantzen
(Applicant's Attorney)

To:

The Commissioner of Patents.

S006381 28/03/89

P/00/008 (as at)
Section 29 (1)
Regulation 3.1 (2)

AUSTRALIA

Patents Act 1990

NOTICE OF ENTITLEMENT

(To be filed before acceptance)

I; John Whitehead

of Colombo Creek, Jerilderie, New South Wales 2716

being the applicant in respect of Application No. 51441/90, state the following:-

Part 1 - Must be completed for all applications.

The person(s) nominated for the grant of the patent:

*is /~~*are~~ the actual inventor~~(s)~~

or

~~*has entitlement from the actual inventor(s)~~

(eg by assignment, by mesne assignment, as legal representative of ...., etc)

Part 2 - Must be completed if the application is associated with one or more provisional applications.

The person (s) nominated for the grant of the patent:

*is / *are the applicant(s) of the provisional application(s) listed on the patent request form and numbered PJ3371 which was filed on 28th. March 1989

or

~~has entitlement to make a request under Section 113 in relation to the provisional application(s) listed on~~ the patent request form

(eg by assignment, by agreement, etc)

~~* Part 3 - Must be completed for all convention applications.~~

The person(s) nominated for the grant of the patent:

*is / *are the applicant(s) of the basic application(s) listed on the patent request form

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*has entitlement from the applicant(s) of the basic application(s) listed on the patent request form

(eg by assignment, by mesne assignment, by consent, etc)

(Continued over)

~~Part 6 - Must be completed if the application relates to a convention country and claims priority under the~~ *Act.*

The person(s) nominated for the grant of the patent:

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*has entitlement from the depositor(s) of the deposit(s) as listed hereafter .....

.....

(eg by assignment, by consent, etc)

Deposit List (by number, deposit institution, date)

.....

.....

.....

.....

(Signature) (Date)

Part 7 - Must be completed if the applicant for a patent of addition is not the applicant or patentee of the main invention.

I, ...

the *applicant / *patentee for *application / *patent No. .....

authorise .....

to apply for a further patent for an improvement in, or modification of, the main invention.

Note: This part must be signed by the applicant/patentee of the main invention.

.....

(Signature)

28-9-94

(Date)

* *Omit/Delete if not appropriate*

(12) PATENT ABRIDGMENT (11) Document No. AU-B-51441/90
(19) AUSTRALIAN PATENT OFFICE (10) Acceptance No. 631615

(54) Title
IMPROVED HAND-HELD POWER TOOL

International Patent Classification(s)
(51)[5] B23B 045/02 B23B 045/00

(21) Application No. : 51441/90 (22) Application Date : 16.03.90

(30) Priority Data

(31) Number	(32) Date	(33) Country
PJ3371	28.03.89	AU AUSTRALIA

(43) Publication Date : 04.10.90

(44) Publication Date of Accepted Application : 03.12.92

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(56) Prior Art Documents
EP 321594
EP 78619

(57) Claim

1. A hand-held power tool including a head provided at each end with a bit-gripping assembly and which is rotatable between two operating positions to bring either assembly selectively to a work station at the forward end of the tool; a guard attached to the handle and behind which is located the rearwardly pointing assembly which is not in use at the work station; a first manually-operable switch for controlling the power supply to the tool; a second manually-operated switch for actuating a mechanism which turns the head to interchange the positions of the assemblies; an energy-storage means having two energy stores and which is charged by initial operation of the tool with sufficient energy to perform two 180° turns of the head so that the positions of the assemblies can be interchanged at least twice; stop means for holding the head in each of its two operating positions; and a device responsive to the head having turned once through 180° to discharge residual energy from the first energy store so that it does not impede operation of the second energy store when eventually it is used to return the original-used assembly to the work station by producing the second 180° rotation of the head.

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Form 10

PATENTS ACT 1952

COMPLETE SPECIFICATION

(ORIGINAL)

FOR OFFICE USE

Short Title:

Int. Cl:

Application Number: PJ 3371
Lodged: 28th. March 1989

Complete Specification—Lodged:
Accepted:
Lapsed:
Published:

Priority:

Related Art:

5013657 16/03/90

TO BE COMPLETED BY APPLICANT

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Tel: (02) 328-7560.

Complete Specification for the invention entitled: IMPROVED HAND-HELD POWER TOOL

The following statement is a full description of this invention, including the best method of performing it known to me:—*

* Note: The description is to be typed in double spacing, pica type face, in an area not exceeding 250 mm in depth and 160 mm in width, on tough white paper of good quality and it is to be inserted inside this form.

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THIS INVENTION relates to a power tool and is more specifically concerned with one adapted to be held and operated in one hand of the user. The tool normally has a chuck assembly enabling tool bits of different size to be fitted to the tool.

Hand-held power tools are widely used. They have the advantage that they can be held with one hand thus leaving the user's other hand free to to hold onto a support such as a step-ladder on which the user may be standing , or to do other things.

The conventional hand-held power tool however, requires the user to use both hands when changing the tool bit. If he is standing on a ladder, he will normally descend the ladder before changing the tool bit. This is often inconvenient and there is a need for a hand-held power tool capable of being used selectively with two different tool bits driven from the same motor and without the user having to move from his working position.

British Patent No. 1,357,007 recognises this need and goes part-way towards meeting it. It describes a hand-held power tool having a chuck at each end of a rotatable drill head, and having a guard which protects the user from contacting the drill head not actually in use. The drill head is manually turnable through 180° to allow the chucks to be interchanged at the work site. However to interchange the chucks, the user must still use one hand to hold the tool and the other hand to turn the tool head so that he has both hand occupied and is not left one hand free to hold onto a ladder on which he may be standing. This is potentially dangerous.

An object of this invention is to provide an improved power tool.

In accordance with the present invention a hand-held power tool includes a head provided at each end with a bit-gripping assembly and which is rotatable between two operating positions to bring either assembly selectively to a work station at the forward end of the tool; a guard attached to the handle and behind which is located the rearwardly pointing assembly which is not in use at the work station; a first manually-operable switch for controlling the power supply to the tool; a second manually-operated switch for actuating a mechanism which turns the head to interchange the positions of the assemblies; an energy-storage means having two energy stores and which is charged by initial operation of the tool with sufficient energy to perform two 180° turns of the head so that the positions of the assemblies can be interchanged at least twice; stop means for holding the head in each of its two operating positions; and a device responsive to the head having turned once through 180° to discharge residual energy from the first energy store so that it does not impede operation of the second energy store when eventually it is used to return the original-used assembly to the work station by producing the second 180° rotation of the head.

The energy stores are preferably mechanical in nature and conveniently comprise springs one of which may be stressed each time the power tool is used. A safety release mechanism is preferably provided to prevent the tool bits being interchanged in position when the tool is operating. The second manually-operated switch is suitably positioned so that when the user requires to change tool bits, he releases the grip on a squeeze switch forming said first switch for controlling power to the tool, and applies pressure instead to a trigger switch which releases the mechanism and provides the second switch. This allows a tensioned spring in the energy storage means to turn the head through 180°, thereby interchanging the positions of the tool bits. The second energy store, which may also be a spring, provides the energy necessary to perform a second 180° movement of the head in the reverse direction to restore the position of the originally-used tool bit to the work station in front of the pistol grip. The energy storage means should be designed to store sufficient energy for at least two 180° turns of the head.

The invention will now be described in more detail, by way of examples, with reference to the accompanying largely diagrammatic drawings, in which:

FIGURE 1 is a vertical section through a hand-held power tool;

FIGURE 2 is an exploded perspective and greatly simplified view of a gearbox used in the tool;

FIGURE 3 is a diagrammatic perspective and greatly simplified view of parts of the tool used to turn a tool head end-for-end, and shows, in an associated part drawing, some of the parts in different operating positions; and,

FIGURE 4 shows a second form of hand-held power tool to which the invention can be applied.

Figure 1 shows a hand-held power tool constructed as an electric drill 1 having a head 2 and a pistol grip handle 3. The drill 1 can be powered by any convenient means such as pneumatically, or electrically by a power cable (not shown) attached to the underside of the handle, or by a battery 4 fitted inside the handle 3 and held in place by a removable closure clip 5.

Power to operate the drill is controlled by a squeeze trigger 6 pivoted at 7 to the upper end of the handle 3 and connected by a link mechanism 8 to a power control switch 10 inside the handle 3. The link mechanism is pivoted to the trigger 6 at 9. The trigger 6 is mounted on the forward side of the handle 3 and a ~~safety~~ release switch 12 is mounted on the rear side of the handle 3. A socketed link 13 is pivoted at 15 to the release switch 12 and receives the adjacent end-portion of the link 8 within its socket. A coiled compression spring 14 mounted ~~inside the socket~~ around the socket link 13 urges the links 13 and 8 apart although they are always held by the shape of the socket in axial alignment.

The upper end-portion of the handle 3 supports an inner race of a ball bearing

17 arranged with its axis vertical. A pulley 18 is fixed to the upper end of the handle 3 by bolts (not shown) and serves to hold the inner race of the bearing 17 in place on the handle 3. A coiled torsion spring 20, forming a second energy store, is located inside the pulley 18 and has one end attached to an upward extension 21 of the handle 3, and its other end to an arm (not shown) attached to the interior wall of the head 2 so as to be capable of turning the head 2 about the vertical axis of the bearing 17, when required.

The head 2 comprises a casing mounted on the outer race of the bearing 17. The outer race is held captive in a socket in the underside of the head 2 by a ring 29. The head 2 contains an electric motor 22 having a central bore 23 through which passes a drive shaft 19. The shaft 19 is rotated by a planet holder 26 mounted inside a cylindrical gearbox 24 shown in more detail in figure 2.

The holder 26 carries three rotatable planetary gears 27 on one side, and a geared boss 28 on the other side. The planetary gears 27 engage axially-extending teeth formed on the interior wall of the gearbox casing which forms an axial extension of a stator of the motor 22. The motor 22 has a hollow output drive shaft 30 carrying a gear 31 inside the gear box and with which the planetary gears 27 mesh. The gear 31 is freely rotatable around the shaft 19.

The geared boss 28 provides the sun of a second planetary gear system mounted inside the gearbox 24 and comprising three planetary gears 33 mounted on a carrier 35. The centre of the carrier is ~~fixed to~~ connected to drive a slow speed output shaft 36 which carries at its end a drill chuck assembly 37 supporting a screw bit 38. The holder 26 rotates faster than the carrier 35 and drives the shaft 19 at a higher speed than the shaft 36 to power a high-speed drill chuck assembly 40 shown at the left-hand end of figure 1.

As is apparent from figure 1, the shaft 36 is actually driven from the carrier 35 by way of a spring loaded friction clutch 42.

The forward end of the shaft 19 drives the chuck assembly 40 and has surrounding it a dog-toothed clutch 44, shown in more detail in the

diagrammatic representation of figure 3, which will now be referred to. The clutch 44 has an axially-fixed toothed part 45 rotatable about the axis of the shaft 19 and which is shown in mesh with an axially-toothed part 46 splined to the shaft 19 to be axially slidable along it. A coiled compression spring 43 urges the two parts 45,46 into engagement. The clutch part 45 united with a pulley 48. The movable clutch part 46 has a waisted collar 50 which is borne upon by a spring 43.

An elongated extendible coiled spring 60 is attached at one end to the outside of the pulley 18 and carries a block 61 at its free end. An extensible flexible cord 62 is attached at one end to the block 61 and passes at its other end around an idler pulley 63 and has its free end attached to the pulley 48.

A plate yoke 68 is pivoted at 74 to the inside wall of the head 2 and has two arms which fit either side, respectively, of the waisted collar 50 so that movement of the yoke about the pivot 74 controls the position of the collar 50 along the shaft 19. A first order lever 70 pivoted at 71 to the inside of the head 2, bears at one end on the yoke 68 to control its position, and its other end is formed with a hole through which the cord 62 extends. The position of the lever 70 is controlled by movement of the block 61.

A spring loaded pawl 80, constructed as a bell-crank lever, is pivoted at 81 to the inside of the head 2 and has operating arm 82 which extends rearwardly and over the position of a latching hole (not illustrated) in the underside of the head and through which an upright and vertically displaceable spring-biassed prod can be inserted. The prod 83 is designed to be moved axially by operation of the release switch 12. The arm 82 normally covers the latching hole. The stiffness of the spring (not shown) resisting retraction of the prod 83 is sufficiently large, compared with that of a spring 84 controlling the position of the pawl 80, to cause the prod 83 to turn the pawl 80 against the bias of its spring 84 without difficulty. The underside of the head is provided with a ramp surface (not shown) leading towards the latching

hole and which ensures that, if the safety switch is released before the movement of the head is completed, the prod 83 is held by the ramp surface in its retracted position until the terminal movement of the head towards its final position is completed. When the head is in its final position, the prod

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83 enters the latching hole and moves the pawl 80 against its spring 84.

The shape of the pawl 80 is such that it does not obstruct movement of the block 61 from right to left, as viewed in figure 3, but when passed by the block 61, the spring 84 forces the pawl 80 upwardly so that it engages behind the right-hand face of the block 61. This prevents the block 61 returning to its former position under the influence of the extended spring 60 which provides the first energy store. The pawl 80 is disengaged from the right-hand face of the block 61 by upward movement of the prod 83, as is apparent from the broken outline disposition of the parts shown in the detail drawing of part of figure 3.

Figure 1 shows that the rear end of the head 2 is protected by a guard 90 which is attached to the upper end-portion of the handle 3 and is open at its sides to allow the head 2 to rotate end-for-end to bring one or other of the drill bits selectively to its forward end. A top bearing 92 attaches the guard 90 to the top of the head 2 so that the two bearings 17 and 92 define a vertical axis about which the head can rotate through 180°.

The release switch 12 has the prod 83 extending upwardly from its upper end, so that when the head 2 has rotated through 180°, the resilience of a spring (not shown) acting on the release switch 12 forces the upper end of the prod upwardly through the hole in the head 2 and against the underside of the pawl arm 82 to release the block 61. The prod 83 thus serves the dual functions of positively locating the head and handle with respect to one another when the 180° rotation is completed, and discharging the residual energy in the tensioned spring 60.

The underside of the head 2 is provided with a second hole diametrically opposite the first hole, so that the prod 83 positively locates the head 2 in either of its two operating positions.

A cut-out mechanism (not shown) incorporated in the handle ensures that the head 2 cannot be rotated unless the power is disconnected.

The drill is operated as follows.

The user, before using the drill, loads the chuck assemblies 37,40 with the appropriate bits he requires. The gearing in the drill ensures that the chuck assembly 40 and the motor 22 rotate at 1100 rpm, and the chuck assembly 37 rotates at 200 rpm. Means (not shown) are provided for reversing the direction of rotation of the motor 22 and thus the chuck assemblies so that, for example, a screw driver bit can be used to screw-up and unscrew screws.

Operation of the drill is controlled by the squeeze trigger 6 in conventional manner, this trigger controlling the supply of electricity to the motor 22 by way of the switch 10.

When the operator first squeezes the trigger 6, the initial drive to the shaft 19 causes rotation of the axially-movable part 46 of the dog-tooth clutch. This rotation is transmitted through the dog-tooth clutch to the axially-fixed part 45 which is free to rotate on the shaft 19. The part 45 rotates the pulley 48 and causes the cord 62 to be wound up onto it in either direction of rotation. The tensioning of the cord 62 causes the spring 60 to extend and the block 61 to travel past the locking pawl 80 and to engage one arm of the lever 70. The lever 70 is turned about its fulcrum and its other arm bears on the hinged yoke 68 and move it in a direction which forces the axially slideable collar 50 against the thrust of the spring 43 so that the dog clutch is disengaged. The pulley 48 is now disconnected from its drive and is free to turn to allow the tension spring 60 to retract slightly. However, this retraction be limited by the engagement of the block 61 with the locking pawl 80. The spring 60 thus remains tensioned irrespective of whether the drill is in use.

If the operator wishes to use the bit gripped in the chuck assembly 37, he releases the trigger 6 and depresses the release trigger 12. He can do this with the drill still held in one hand. Depressing the release trigger 12 withdraws the prod 83, attached to it, from the hole in the casing of the head so that the head is now free to be rotated by the tension in the spring 60 about the axis of the bearings 17 and 92.

During this rotation of the head in the clockwise direction as viewed from the top of figure 1, the tension in the spring 60 progressively relaxes and the tension in the torsion spring 20 inside the pulley 18 progressively increases.

On completion of the 180° of movement, determined by a stop (not shown) on the handle, the hole in the underside of the casing of the head previously at the forward end of the handle 3, now locates above the prod 83 on the locking trigger 12. As the trigger 12 is by now released, the prod 83 passes upwardly through the hole under the action of its spring bias, and engages the underside of the pawl arm 82. This causes the pawl to move out of engagement with the right-hand face of the block 61 and allows the spring 60 to retract fully to its rest position at which it is totally unstresses. However, the torsion spring remains stressed and is now urging the drill head to rotate back to its original position. This torque is naturally resisted by the engagement of the prod 83 in the drill head hole.

To restore the chuck assembly 40 to the forward end of the drill, the operator presses the locking trigger 12 again to extract the prod 83 from the drill head hole. The torsion spring 20 then turns the drill head 2 around the axis of the bearings 17 and 92 to its former position. The locking trigger 12 is then released and the prod 83 re-enters the hole in the drill head in which it was originally located. The drill is then ready for use once again.

The invention is applicable to any form of hand-held powered tool. Figure 4 shows an alternative form of tool structure using a different form of handle which is here referenced 100. Other parts of the tool similar to those already described with reference to earlier figures, are given the same references but they are primed and will not be again described.

CLAIMS

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:.

1. A hand-held power tool including a head provided at each end with a bit-gripping assembly and which is rotatable between two operating positions to bring either assembly selectively to a work station at the forward end of the tool; a guard attached to the handle and behind which is located the rearwardly pointing assembly which is not in use at the work station; a first manually-operable switch for controlling the power supply to the tool; a second manually-operated switch for actuating a mechanism which turns the head to interchange the positions of the assemblies; an energy-storage means having two energy stores and which is charged by initial operation of the tool with sufficient energy to perform two 180° turns of the head so that the positions of the assemblies can be interchanged at least twice; stop means for holding the head in each of its two operating positions; and a device responsive to the head having turned once through 180° to discharge residual energy from the first energy store so that it does not impede operation of the second energy store when eventually it is used to return the original-used assembly to the work station by producing the second 180° rotation of the head.

2. A tool as claimed in Claim 1, in which the energy stores comprise springs which are located between the handle and the head and which are selectively operable to rotate the head in opposite directions respectively.

3. A tool as claimed in claim 1 or claim 2, including a clutch through which power is transmitted to charge the energy storage means when the drill is first operated, and a release mechanism which responds to the energy storage means being fully charged, by disconnecting the clutch.

4. A tool as claimed in any one of the preceeding claims, in which the energy storage means is charged by the tensioning of a cord passing around a pulley rotated by initial operation of the tool.

5. A tool as claimed in any one of the preceeding claims, including a gearbox in the head and formed at one end of a motor, the gearbox comprising an internally toothed cylinder containing two planetary gearing systems one of which has its sun gear driven by a hollow output drive shaft of the motor and its planet carrier driven by a relatively high-speed output shaft which passes through the hollow drive shaft of the motor and drives a first chuck

assembly at one end of the head, the second planetary system being driven by a sun wheel fixed to the central portion of the planet carrier of the first planetary system and having a planetary gear holder connected to drive the chuck assembly ar the other end of the tool head.

6. A tool as claimed in any one of the preceeding claims, arranged and adapted to operate substantially as described with reference to figures 1 to 3 of the accompanying drawings.

7. A tool as claimed in claim 6, modified substantially as described with reference to figure 4 of the accompanying drawings.

8. A tool as claimed in any one of the prceceding claims, contructed as a double-ended drill.

Dated this 16th day of March 1990.

JOHN WHITEHEAD

By: H.J. Rankin

Applicant's Patent Attorney.

DRAWINGS

51441/90

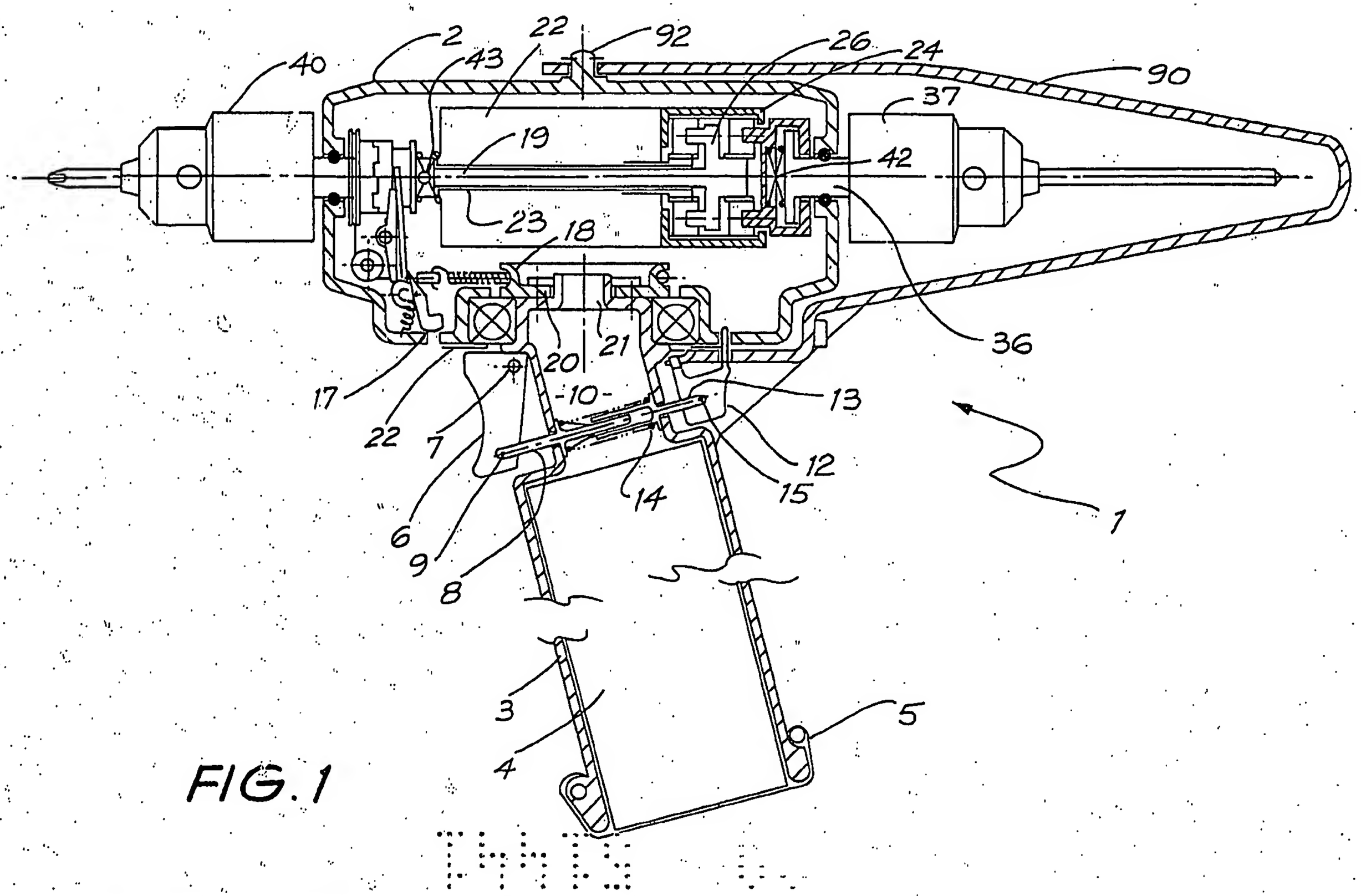

FIG. 1

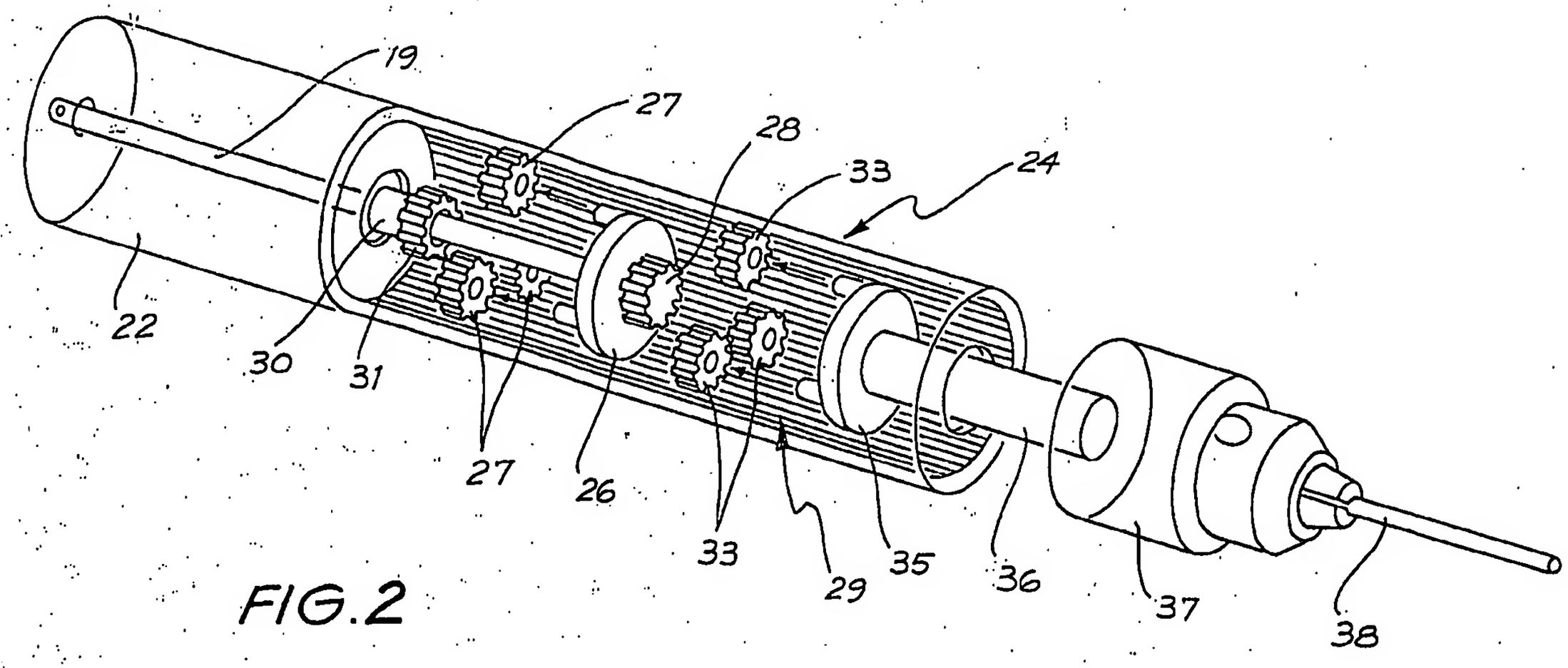

FIG.2

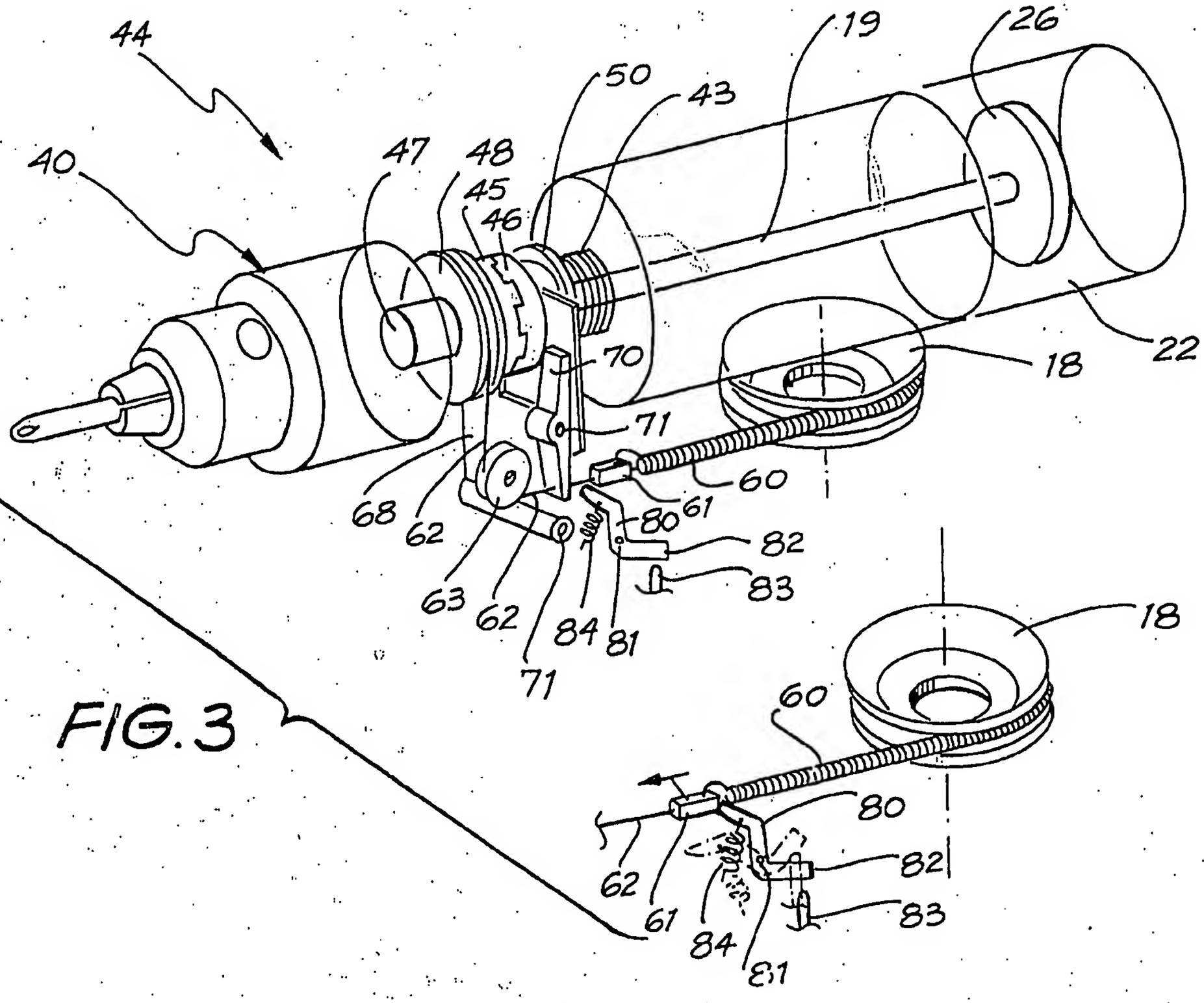
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FIG. 3

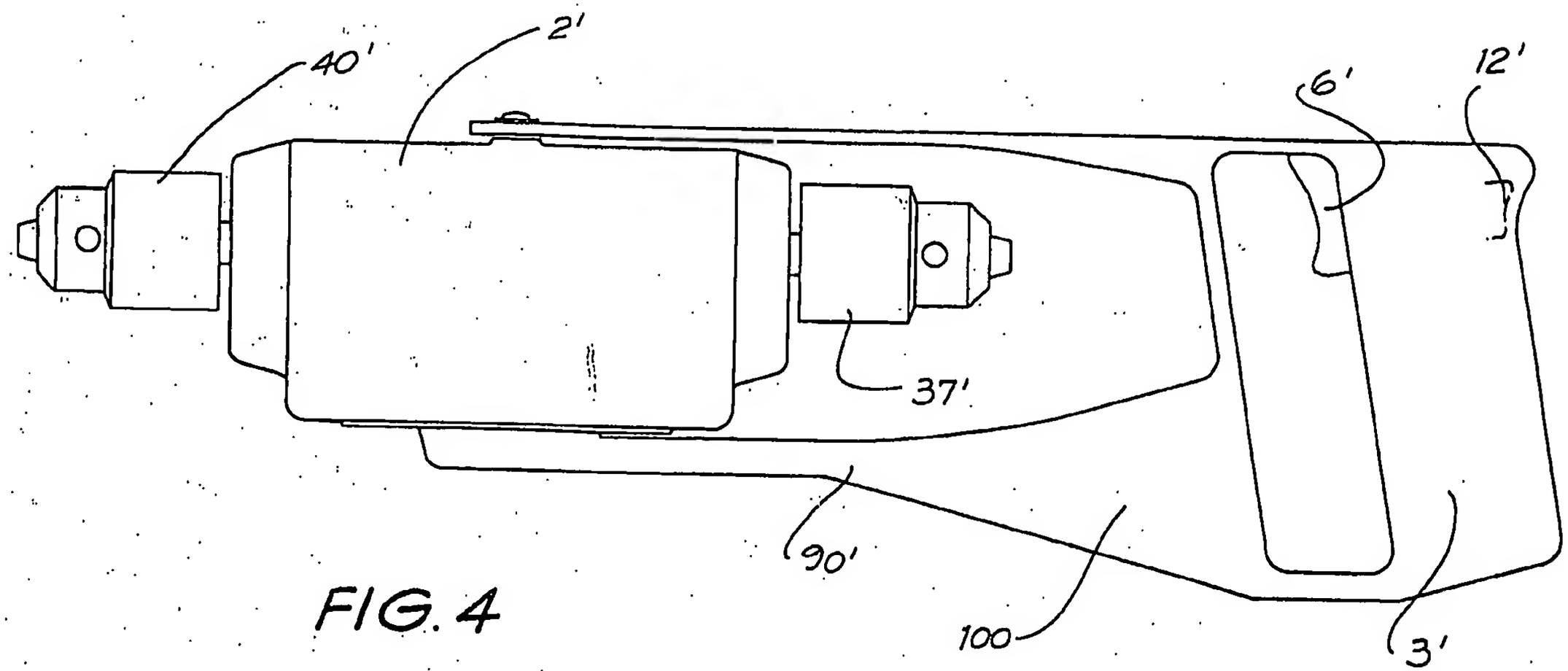

FIG. 4